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PSYCHOLOGY.[1]

Rapid Calculators.—In 1894 Prof. Binet published an elaborate series of tests made on two well-known "lightning calculators," Diamandi, a Greek, and Inaudi, an Italian. A notable result of these tests was to show that while one of the pair, Diamandi, was of a visual type, like most professional calculators, the other, Inaudi, was exceptional in being auditory. Thus while the former committed numbers to memory more readily when they were written out, and was able to repeat a square of figures, once memorized, by rows or columns with equal facility, the latter learned numbers more rapidly when they were given orally, or by speaking them himself, and found it difficult to repeat them afterwards in any other order than that in which he had committed them. Inaudi always accompanied his calculations by slight lip and throat movements, and when asked to make a constant and uniform sound during his work, declared himself wholly unable to perform the required operations.

These observations have recently been supplemented by a monograph study by Sign. Guicciardi and Ferrari[2] of an Italian, Ugo Zaneboni, who has lately been giving exhibitions of his skill as a calculator. They found him to be visual in type, like Diamandi, with whom, however, he could not compare for speed and versatility.

The most noticeable point about Zaneboni is the wide difference between his power of acquisition and his power of retention. In the former respect he is decidedly mediocre. Thus he required nearly seven minutes to memorize a series of 25 numbers, which he was told were to be repeated by him the next day; the next day he was unable to give more than the first four correctly. On the other hand, his power of retention was extraordinary. Its material appeared to be supplied by an automatic process of acquisition, since voluntary memorizing on his part was possible only by a distinct effort of the attention. During his years of military service, Zaneboni was frequently posted at a railroad station. He spent his spare time there in reading and re-reading the time-tables; as a result he is now able to give correctly from memory the distances between any two places in Italy, with the fares for each class. At another period in his life he memorized a list of 227 cities, Italian and foreign, with their population, which he uses in his public exhibitions; e. g., the figures representing the population of any two of these cities being given him, combined into a single number and in any order, he will give the names of the cities. He has also committed to memory a large number of squares, cubes, etc., up to the fifth power, as well as many products of two-place numbers; i. e., his multiplication table extends with some breaks to 100 x 100, instead of 12 x 12. With the help of these known solutions he is able to perform arithmetical operations with great rapidity; he recognizes perfect squares, cubes, etc., at a glance, and in performing multiplications breaks up the given numbers into parts with whose products he is already familiar. His power of retention is the sole source of this facility in calculation; he has no special aptitude for performing the operations themselves. This was clearly demonstrated by a comparison of his time with that of Diamandi and Inaudi, in the tests made on this point. In the simpler operations, involving results with which he was familiar, his time was but slightly longer than theirs; but as the task grew more complex and the numbers required more breaking up into factors according to his method, his time increased to double and sometimes even four times theirs. The tests of addition, subtraction, multiplication and division given him were identical with those given to Inaudi by Prof. Binet, so that their respective results admit of direct comparison here. The other calculators seem to have had some natural facility in handling new problems, or at least new examples of old problems: with Zaneboni the only special gift was a memory for numbers, and that was a retaining, not an acquiring aptitude.

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[1] Edited by Howard C. Warren, Princeton University, Princeton, N. J.

[2] Rivista Sperim. di Freniatria, 1897, XXIII, fasc. 1 and 2.

Another point of interest in Zaneboni was his visual type. This characteristic revealed itself in several ways. In his public exhibitions he preferred to have the numbers written out on the board, rather than spoken. His visual reactions were short from the first, and very constant (205σ). He was able to read eight figures shown by an instantaneous electric flash, while ordinary individuals were only able to distinguish three or four under the same conditions. Out of 50 words, selected from widely different spheres as a test for association, 35 gave visual associations in his case, and of the remainder 9 failed to call forth any association whatever. All these tests combined to demonstrate the essentially visual character of his ideational processes.

Like most other professional calculators, Zaneboni's interest centers wholly in his profession; beyond it he has no tastes and little general knowledge. " He rises shortly before noon, walks a little, dines at two, then walks again or goes to some café, and about seven o'clock goes to the theater. After the performance he retires, on reaching his house, shortly after midnight. He talks with few persons, shuns large gatherings, reads little, and is but little interested in what he reads, because, to use his own expression, 'his memory is always in his calculations.'" In short, while his memory for numbers is abnormally developed, all other sides of his intellect are atrophied. The tests which Sign. Guicciardi and Ferrari undertook along other lines than that of figuring failed signally, because of his lack of interest and attention. He was always inquiring what was the use of doing these—they were not in his line at all. For this reason many of the usual tests had to be abandoned or altered so as to bring in merely numerical data. However, these negative results are as truly indicative of his real nature and disdisposition as the successful tests, which they serve to conform.

Visual Perception of Depth.—Some experiments on the visual perception of depth are reported by M. B. Bourdon in the "Revue Philosophique" for January, which, if they warrant the deductions which he draws from them, will necessitate a modification of the accepted theories of space perception. The special object of the experiments was to isolate the depth data furnished directly by monocular and binocular vision, respectively, from the elements of judgment ordinarily attaching to them—such as known size, brightness, number of intervening objects, etc. To accomplish this the tests were made in a long hallway in the cellar of a large building and at night, when the cellar was completely dark. Two lanterns were placed at different distances, their light being of so small an intensity that the hall itself was not illumined; the effect was merely of two bright points of light.

In the monocular tests, the lights were first placed in position, and the subject was then led with eyes blindfolded to the spot chosen; one eye remained covered during the experiment. The subject was asked to determine which of the lights was the nearer. The experiment was tried with five subjects, and for distances ranging from 1 to 30 meters. It was found that even with the latter difference there was no preponderance of right judgments, while a slight difference of intensity between the lights led uniformly to a judgment in favor of the brighter. The author concludes that the muscular sensations accompanying changes of accommodation play no part in the estimate of depth, at least for distances greater than one meter.

For the binocular tests the author used two hallways at right angles to one another, the subject being stationed at their point of intersection. One of the lights was placed in each of the halls. When the further light was 25 meters distant, right answers were generally given when the other light was 6 meters or less; if the nearer light was 10 meters distant or more, the wrong answers predominated; the threshold value was about 7–8 meters, or a difference of 17–18 meters. Another set of experiments was tried in which the subject was asked to estimate binocularly the absolute distance of a single light. The results showed no approximation to the truth, the estimates for 50 meters being in several cases nearly the same as those for 5 meters. According to the author, the muscle sensations—in this case of convergence—play no appreciable part here; it is only the bi-retinal assimilation of corresponding points that determines our sensation of depth. Thus our perception of depth, in so far as it is a sensation at all, and not a judgment, is really a visual function, and not a muscular one, as the commonly accepted theories incline to believe. The results seem to show that the visual *sensation* horizon is about 220 meters from the eye. The spherical shape of the heavens is due to the practical parallelism of all objects further than that distance, as determined by the minuteness of bi-retinal localization, rather than to the absence of changes of accommodation and convergence for greater distances.—H. C. W.

ANTHROPOLOGY.[1]

On Fossil Bird-Bones Obtained by Expeditions of the University of Pennsylvania from the Bone Caves of Tennessee.—On the 20th of last June (1896) the writer received from Professor E. D. Cope a small collection of subfossil bones obtained by Mr. H. C. Mercer while in charge of explorations for the University of Pennsylvania in the Bone Caves of Tennessee. These bones were kindly sent to me for the purpose of having them identified if possible, and eventually described and figured. As in the case of many cave bones, they are not encased in any matrix, being to some degree pliable rather than brittle and completely fossilized. They have a rather pale clayey color, and not more than one in a dozen of them are perfect. Indeed, it is unfortunate that so many of them are in too fragmentary condition to be identified with any degree of certainty, and in the case of a few mammal bones I found in the collection no attempt was made at identification at all. Skulls and sterna are entirely absent from this collection, nearly all the specimens being long bones, with the exception of the sacral portion of one pelvis; a few coracoids and portions

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[1] This department is edited by H. C. Mercer, University of Pennsylvania.